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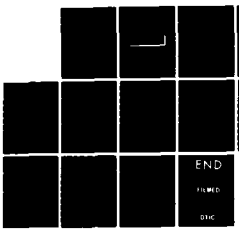

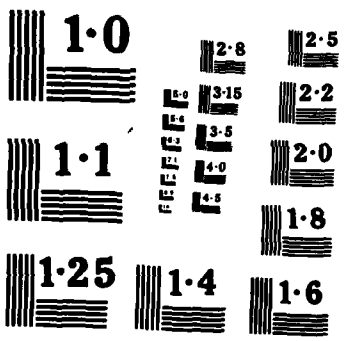
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FINAL REPORT

AMSAA

AD-A154 127

ANNUAL REPORT
FISCAL YEAR 1984

INVENTORY RESEARCH OFFICE

January 1985

US Army Inventory Research Office
US Army Materiel Systems Analysis Activity
800 Custom House, 2d & Chestnut Sts.
Philadelphia, PA 19106

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report describes work done by the US Army Inventory Research Office during the period October 1983 - September 1984. Reports published during the period are listed, along with papers presented at professional meetings and notes on other professional activities.

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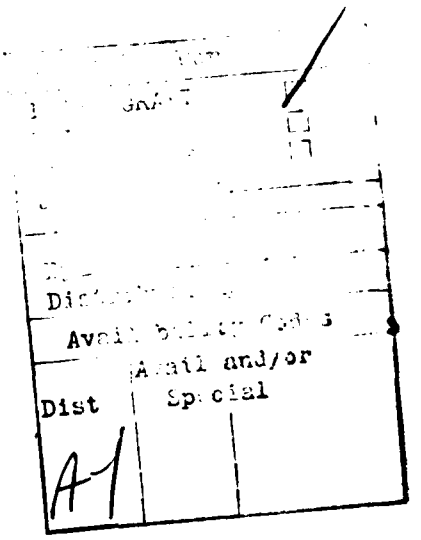

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US ARMY INVENTORY RESEARCH OFFICE
OVERVIEW

This report describes IRO activities in FY1984. Annual Reports for previous years go back to FY1966.

There has been a shift in the nature of the IRO work program over the past several years from one oriented to solving specific delineated problems to one oriented to specific missions. As more and more IRO developed models are implemented, we are finding that maintenance of these takes more and more of analysts' time. For example, maintenance and enhancement of SESAME, the sparing to availability model, is now a large and regular part of our work program. Similarly, the Optimal Allocation of Test Equipment/Manpower Evaluated Against Logistics (OATMEAL) model, now more usually referred to as OSAMM, requires time because it is going through an enhancement stage and is gaining more potential users as the use of Level of Repair Analysis models becomes more the norm through standardization of the LSA process. We have continued also with support of the Combat PLL/ASL program. Although little modelling work was done, considerable time was spent with production runs, assistance to MRSA for data editing, assistance to DA/DCSLOG in support of the test ASL, and in planning assistance to AMC.

An area of particular interest to IRO is weapon system management being mandated by OSD, and which will eventually provide a common focus for logistics support planning. IRO assisted AMC and DA/DCSLOG with development of the Army Plan of Action for weapon system management and will likely play a role in implementation of related weapon system management procedures. During this year, development work was completed on a dynamic version of SESAME, which allows estimation of operational availability as a function of time when input parameters vary with time and when available assets are known. Work is just beginning on implementation of this model but we expect it to be used for combat stockage computation and for sustainability assessments, both key elements of weapon system management.

Personnel Matters:

Maria Zmurkewycz was hired as an Operations Research Analyst in September after working as a temporary employee in the summer. She has a MBA from Temple University and specialized in Operations Research.

Karl Kruse, after serving as interim chief of IRO since December 83, was appointed as Chief in September.

Performance awards were given to Alan Kaplan for sustained superior performance and to Ed Gotwals for his work on the Supply Performance Indicators project.

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US ARMY INVENTORY RESEARCH OFFICE
COMPLETED STUDY SUMMARY

TITLE: Maintenance Data Management System Cost/Benefits Analysis

IDENTIFICATION NUMBER:
IRO Project No. 296

SPONSOR: AMC Deputy Chief of Staff for Supply, Maintenance and Transportation
AMCSM-SA

PROJECT OFFICER:
Arthur Hutchison

INITIATION/PROGRAMMED COMPLETION DATES:
March 1984/November 1984

ABSTRACT: The Army Audit Agency requested that AMC update the cost/benefit statement for the Maintenance Data Management System (MDMS). The original/cost/benefit statements were dated and prepared under guidelines subsequently changed. The objective of this study was to provide AMC cost and benefit data to be used in preparing the necessary document.

MAJOR CONCLUSIONS/RECOMMENDATIONS:
Development, implementation, and training costs for MDMS were collected from the MSC's, LOGC, ALMSA, DESCOM, and other activities.

To compute benefit estimates it was necessary to measure only the cost savings in inventory resulting from shorter times to initiate and update secondary item depot overhaul requirements. Under MDMS it was projected that Repair Administrative Lead Times (RALT) would be cut sufficiently to provide an inventory costs saving in excess of the cost to develop and implement MDMS.

IMPLEMENTATION STATUS:
The results of this study were forwarded to AMC and were used to update MDMS cost justification statements.

RELATED STUDIES:
None.

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Advanced Inventory Models

IDENTIFICATION NUMBER:
IRO Project No. 062

SPONSOR: Work of this kind is undertaken according to IRO perceptions of where basic theoretical advances are needed.

PROJECT OFFICER:
N/A

INITIATION/PROGRAMMED COMPLETION DATES:
Ongoing.

PROBLEM: New and challenging logistics problems constantly arise in the Army that require advances in the practice of basic Inventory Theory and other areas of Operations Research. Theoretical work of this kind is carried on under this project number.

OBJECTIVES: To carry on in Inventory Theory and other areas of Operations Research where it is believed that development of improved models is limited by gaps in presently known theory.

CURRENT STATUS:
Inventory models with learning pertain to the provisioning environment in which the initial estimates of the demand rate is based on engineering estimates, and is then improved as demand experience accumulates. A report was prepared documenting the development of a model for this situation, and the insight gleaned from use of the model on an experimental basis.

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Operational Readiness Oriented Logistics Support Models

IDENTIFICATION NUMBER:
IRO Project No. 260

SPONSOR: AMC Directorate for Supply, Maintenance & Transportation, AMCSM-WRS/PMP

PROJECT OFFICER:
Alan Kaplan/Martin Cohen/Meyer Kotkin/Steven Gajdalo

INITIATION/PROGRAMMED COMPLETION DATES:
October 1977/Continuing Project

PROBLEM: Multi-echelon inventory models allow the achievement of system operational availability goals at least cost. A number of models exist in the literature, but none was fully satisfactory for Army use.

OBJECTIVES: To develop and promote use of improved multi-echelon models such as SESAME and related models.

CURRENT STATUS:

The IRO continued to work through the medium of the Provisioning Technical Working Group (PTWG), which maintains control of SESAME program content by developing change and enhancement proposals and their implementation priorities, and whose members act as focal points for application of SESAME at their Commands.

Last year the PTWG decided to completely redesign SESAME. Significant progress was made in this effort. Technical improvements to the optimization routines were developed and programming for the redesigned SESAME. Input/output routines were completely restructured and programmed. CECOM has written a pre-processor for use by all MSCs to provide SESAME input in the presented form. Completion of the programming, testing, and preparation of user instructions will be done in the first half of 1985. Availability of the new SESAME fielding at all MSCs is expected by August 1985.

Presently SESAME does not consider module redundancy. An algorithm for doing so was developed. In order to treat redundancy properly, it is necessary to model the implications of a finite source for demand. The algorithm assumes that the correction for finite source which is theoretically proper when order and ship times are independent may also be used in the SESAME context when order and ship times are not independent. A simulation was developed. The simulation indicated that there was little loss in accuracy in using the finite source correction.

Some work was done on the SESAME/CCSS interface. A refined

method of loading "K" cards in CCSS was recommended and approved for implementation. This will be included in the redesigned SESAME to be available in August. More ambitious plans to incorporate SESAME in CCSS will be addressed by a work group to be formed in 1985. IRO will be a member of this work group.

RELATED STUDIES:

1. Combat PLL/ASL Methodology (IRO Project 283 - Ongoing)

2. War Reserve ADP System Project (IRO Project 281 - Completed)

3. Supply/Maintenance Trade-Off Analysis (IRO Project 287 - Ongoing)

4. SESAME User's Guide, DARCOM Pamphlet 700-18, 29 July 1983.

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: RIMSTOP Implementation

IDENTIFICATION NUMBER:
IRO Project No. 261

SPONSOR: DCSLOG - Army Assistant Director for Supply Management
DALO-SMP-U

PROJECT OFFICER:
Robert Deemer

INITIATION/PROGRAMMED COMPLETION DATES:
May 1978/September 1985

PROBLEM: RIMSTOP has been implemented at intermediate (SAILS-ABX) sites and at AMC installations. The large number of low demand items and items demanded during one year but not the next make projecting demand accommodation and other inventory performance measures difficult. Moreover, some inventory managers were not pleased with stockage decisions produced by the RIMSTOP model, citing increased number of lines stocked, decreasing depth of stockage and negative safety levels. Meaningful performance statistics are difficult to analyze for SAILS-ABX because of lack of a reliable performance report. AMC installations are fairly well satisfied with their operations.

OBJECTIVES: Improve performance projection capabilities of the RIMSTOP forecasting module by taking into account the large number of low and intermittent demand items.

Assist FORSCOM and other MACOMs in developing capability to run the LAMBDA-Generator.

CURRENT STATUS:

Two data bases were developed with two years of DSU demand. Several performance projection techniques were derived with only minor improvement observed. The development of an accurate performance projection is essential for the usefulness of the LAMBDA-Generator.

The short term DSU implementation testing was restricted to DAYS-OF-SUPPLY (DOS) - fixed operating level/safety level - and an ECONOMIC ORDER QUANTITY (EOQ) - economic operating level-/fixed safety level. To keep the number of lines stocked at DSU to a minimum, DCSLOG decided to limit stockage to essential and legal/safety items only. Our testing indicated the EOQ policy is significantly better for almost all the measures which were observed. The fixed single quantity add/retain also gave less desirable results than the policies with several add/retain criteria. No testing was done for the full RIMSTOP model.

FORSCOM has a working LAMBDA-Generator program. They ran results of the forecasting process against their SAILS Demand Evaluator and found some very large discrepancies. We are looking into what the two procedures are doing to create such large differences.

AMC installations are updating their LAMBDA-values and the performance measures appear to be increasing for most installations. Availability is still quite low however and will probably never increase to levels originally conceived because of the nature of the business the retail installations perform.

Draft report of various alternatives for projecting performance and operational modifications was written.

We are waiting for a convenient time to pursue evaluation of RIMSTOP through a simulation against actual 1st Armor Division demands on the main DSU.

RELATED STUDIES:

1. "Calculation of Percent Error Tables for Use in the RIMSTOP Implementation," Arthur Hutchison, IRO Technical Report, September 1980, ADA090141.

2. "Evaluation of Several Forecasting Techniques for Retail Level Stockage," Arthur Hutchison, IRO Technical Report, September 1980, ADA090104.

3. "Comparison of RIMSTOP (Retail Inventory Management Stockage Policy) to Current Retail Inventory Policies," Arthur Hutchison, IRO Final Report, November 1981, ADA119428.

4. "Developing Requisition Short Cost Parameters for RIMSTOP (LAMBDA-Generator)," Robert Deemer, IRO Technical Report, April 1983, ADA128370.

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Evaluation of Provisioning Procedures

IDENTIFICATION NUMBER:
IRO Project No. 265

SPONSOR: AMC Directorate for Supply, Maintenance & Transportation
AMCSM-PM

PROJECT OFFICER:
Donald A. Orr

INITIATION/PROGRAMMED COMPLETION DATES:
May 1979/Depends on AMC decision on further testing.

PROBLEM: Many Army proponents feel initial support requirements (Spare & Repair Parts), when determined in accordance with DoDI 4140.42 policies, are inadequate to support newly fielded systems at their required operational availability. To bolster or belie this intuition, evaluations of provisioned quantities based on field performance are needed. Although Army policy requires such evaluations (Post Provisioning Review) 360 days after initial deployment of the end item, such analyses have been barely extant at best. A main (but not the only) reason for the dearth of reviews has been a lack of a paradigm and consequent systematic procedures for collecting and analyzing data in a reasonable, feasible manner.

With the advent of SIP and the sophisticated SESAME program, it is feasible to compute part quantities in accordance with .42 or with some cost effective optimal technique. These programs, suitably adjusted, can also evaluate the impact of these support quantities and other possible realized quantities in terms of system availability. Another potentially solvable problem via the program is to assess the impact on quantities and operational readiness when the actual provisioning parameter set (experienced field values of repair times, task distributions, washout and failure rates) differs from the original parameter set used to ascertain initial issue.

OBJECTIVES: Phase 1 - To design an evaluative system for detail comparisons of theoretical, hypothetical, and actual provisioning quantities and subsequent operational readiness values. To consider computed SIP, ERPSL models' quantities and real life adjustment thereof. To use the above evaluator on data obtained from pilot tests on selected end items and identify any shortcomings in DoDI 4140.42 procedures.

CURRENT STATUS:
This project has become one phase of an expanded provisioning study taken over by AMSAA. This expanded project is planning

to study the budgeting process, general problems in provision and fielded systems that are similar to those currently being provisioned. The IRO has been working with MSCs and PMOs on sample data collection plans and evaluative schemes for the M1 tank. Data on the M1 tank are being collected by PECO Enterprises, Inc., and stored and retrieved thru the INFONET system of Computer Science corporation.

During FY83 data was collected thru INFONET on replace and repair actions for the LRUs that constitute the major provisioning cost on the M1. Original failure factors, maintenance task distributions, and replacement task distributions were compared with updated ones from the field data.

Many SESAME runs were made with the old and updated parameter files. The results reconfirmed SESAME as the superior procedure for determining initial issue quantities to be given to the field. SESAME quantities can achieve better availability for less dollars. On the M1, if the user were to use updated parameters, the provisioning dollars would increase 30-80 percent.

This study indicated that if the user uses SDC data (or similar) to truly update, he can improve, thru SESAME, his provisioning for further deployments of the system. Further "revalidation" of SESAME thru SDC data analyses do not seem necessary.

The report "Organized Procedure for Evaluating SESAME: The M1 Case Study" has gone thru several levels of review within AMSAA, and due to high level of interest and to many readers permitted to make comments, several cycles of changes have been incorporated. At this point it is finally off to the printers.

RELATED STUDIES:

"Provisioning Methodology Validation Assessment Study," AMSAA Project No. 81-5A.

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Supply Performance Indicators

IDENTIFICATION NUMBER:
IRO Project No. 278

SPONSOR: AMC Directorate for Supply, Maintenance and Transportation
AMCSM-SO

PROJECT OFFICER:
Edwin Gotwals

INITIATION/PROGRAMMED COMPLETION DATES:
October 1979/May 1985

PROBLEM: Presently there are no statistics collected on a routine basis that can give early warning of changes in conditions which might degrade stock availability. Based on findings from the IRO Project 267, "Stock Availability Improvement," it is felt that by monitoring the errors made when estimating key input parameters to the supply control studies, trouble areas can be spotted in time to do something about them.

OBJECTIVES: To identify the model parameters in CCSS whose forecast errors most affect supply performance and to develop a method to monitor these errors.

CURRENT STATUS:

A pilot program will be run at TACOM. They have completed most of the data extract programs and are saving operational data for analysis. The other MSCs have been asked by AMC to begin saving data. IRO consulted with Jet Propulsion Labs (JPL) on a Data Base Management System which is implemented at AMSAA. AMC determined that this project will also satisfy the performance monitoring requirements of the Depot Level Reparables Action Plan (DELRAP) and has therefore agreed to provide funding support. These funds were used to contract with JPL for writing Data Base Management Systems programs for the pilot at TACOM and for developing approaches for a AMC-wide implementation.

A major portion of the prototype data base is completed and resides in the AMSAA VAX/VMS computer. The data consists of two years of demands, returns, disposals (DRD) history for approximately 500 NSN's (M60 Tank) and Supply Control Study data for one month on approximately 80 NSN's (M60 Tank). Shortly the SCS portion of the data base will be expanded to also span 500 NSN's over the two year time frame.

An application package, the Supply Management Analyzer (SMA), is currently being developed. The SMA will be a menu oriented interactive application where the user will be able to generate

statistical analyses on any portion of the data base. The SMA will contain interactive queries for selecting portions of the data base and also statistical routines for analyzing the data. Implementation details are being worked on with AMC Headquarters.

RELATED STUDIES:

IRO Stock Availability Improvement Briefing, April 1978, (IRO Project 267).

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Combat PLL/ASL Methodology

IDENTIFICATION NUMBER:
IRO Project No. 283

SPONSOR: AMC Directorate for Supply, Maintenance and Transportation, AMCSM-PM

PROJECT OFFICER:
W. Karl Kruse/Martin Cohen

INITIATION/PROGRAMMED COMPLETION DATES:
March 1980/September 1985

PROBLEM: This is the IRO portion of DA-sponsored work to develop stockage lists for Organizational and Direct Support Units. The lists are to contain the parts needed for combat operations.

OBJECTIVES:

To develop an automated method of producing least-cost stockage lists that will meet operational availability targets for essential end items without hampering mobility. The IRO's responsibility is the development and evaluation of initial lists. It is expected that MRSA will take over production of Combat PLL/ASLs once the models and procedures are deemed to be operating satisfactorily.

CURRENT STATUS:

Mandatory Parts Lists (Recommended Organizational Stockage) methodology has been developed and lists have been prepared for the Armor, Mechanized Infantry and Combat Support Divisions. IRO will also run Aircraft and Combat Service Support MPLs, complete the tuning of the model and transfer the computer program to MRSA early in 1985. MRSA will perform all data processing and be responsible for all parts of the computer program except the actual stockage model, which will be maintained by IRO.

A trial ASL for the First Armored Division is now being evaluated. MRSA has taken responsibility for much of the data-processing support here too. The use of field demand data has now been incorporated into MSC development of the input data.

This work is being carried on in conjunction with MRSA, the AMC MSC's, other elements of AMSAA, the Army Logistics Center and TRADOC activities.

RELATED STUDIES:

"War Reserves ADP System Project," IRO Project No. 281 (completed).
DRACULA, IRO Project No. 295 (transferred to MRSA).

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Supply/Maintenance Trade-Off Analysis

IDENTIFICATION NUMBER:
IRO Project No. 287

SPONSOR: US Army Communications-Electronics Command, AMSEL-PL-SA

PROJECT OFFICER:
Donald Orr/Alan Kaplan

INITIATION/PROGRAMMED COMPLETION DATES:
November 1980/May 1985

PROBLEM: In developing a logistical support concept for a weapon system to be deployed, supply and maintenance decisions are made that impact the life cycle cost of the end item in question. In order to make the most of the Army's investment in dollars and manpower, optimization of the process that leads to initial commitments of stockage, repairmen, test equipment, and transport over several echelons of support is highly desirable.

Currently existing maintenance support of life cycle cost models used by the Army that make repair level and stockage decisions for the user, do not truly optimize by considering the trade-offs and interactions amongst the repair, supply, and transport processes. There is a need to marry an initial supply support program which makes multi-echelon stockage decisions in a cost-effective manner with an efficient algorithm for allocating repair and test equipment and skilled personnel to the various repair echelons.

OBJECTIVES: 1. To develop a hands-on computer program for making stockage and repair decisions in a multi-echelon environment.

2. Program will operate with input sets similar to SESAME and GEMM models in order to give the user guidance on where to repair, what to repair, where to place test equipment.

3. Program will accept user specified constraints on what are desirable solutions.

4. Program will be "portable" (i.e., it will be easy to adapt for use on a variety of computers).

5. Current state of the art techniques will be applied to quickly develop a product which is significantly better than current computer packages. Subjects for future research and refinement will be identified and treated in a follow-on effort.

CURRENT STATUS:

The IRO has developed a mixed integer program that, in conjunction with SESAME (which produces stockage costs) and a pre-processor (which produces Test Equip/MOS and transportation costs), determines optimal task distribution and placement of TE/MOS. The pre-processor was developed by CECOM systems analysis group.

The OATMEAL program (the integer LP) has been successfully used at CECOM. An enhanced version is now being designed in conjunction with CECOM. This version includes screening decisions, and a final report has been written and printed choosing among TE alternatives.

As last year this project number has also been used to investigate the proper use of ORLA models (including OATMEAL) in the Logistics Community. Also a report on a procedure for allocating general purpose TE across weapon systems and echelons (the "Red Tomato" model) is undergoing peer review.

Also, as reported herein elsewhere, the project number covered consultation, meetings, and computer analyses for the IFTE COEA.

RELATED STUDIES:

AMSAA study - M109 General Test Equipment Requirements Analysis (in progress).

Alan Kaplan paper "The OATMEAL Model," Multi-Echelon Inventory Systems Conference, December 1982, Washington, DC.

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Implementation of RIMSTOP for Reparable Items

IDENTIFICATION NUMBER:
IRO Project 291

SPONSOR: Deputy Chief of Staff for Logistics, Army Assistant Director for Supply Management, DALO-SMP-U

PROJECT OFFICER:
Arthur Hutchison

INITIATION/PROGRAMMED COMPLETION DATES:
June 1982/June 1985

PROBLEM: USAREUR has experienced problems with the current AR 710-2 stockage policies when used for levels computations for management of major assemblies. The policy is not applicable to a multi-echelon environment, and is particularly inappropriate when level of operating tempo is variable.

OBJECTIVES: To develop a stockage model for management of major assemblies in USAREUR.

CURRENT STATUS:
A multi-echelon stockage model was programmed on the IBM Personal Computer in order to evaluate problems and procedures of introducing multi-echelon stockage policy at the retail level. Major Assemblies stockage requirements for several weapon systems were produced for the V and VII Corps in USAREUR.

To compliment the stockage computations program, an asset distribution procedure was added to the software package. This procedure allows the user to determine where assets in short supply should be stocked as they enter the multi-echelon structure.

RELATED STUDIES:
1. "Mathematics of the SESAME Model," Alan Kaplan, IRO Technical Report, February 1980.

2. "On the Optimal Stock Levels in Multi-Echelon Maintenance System," Meyer Kotkin, IRO Technical Report, June 1978.

3. "Major Assemblies Stockage System," Arthur Hutchison, Inventory Research Office.

4. Major Assemblies Stockage System Users Guide for the IBM PC. (To be published)

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: Dollars vs Readiness

IDENTIFICATION NUMBER:
IRO Project No. 294

SPONSOR: AMC Directorate for Supply, Maintenance & Transportation
AMCSM-W

PROJECT OFFICER:
Karl Kruse

INITIATION/PROGRAMMED COMPLETION DATES:
February 1982/Indefinite

PROBLEM: Supply management activities within AMC are commodity, rather than weapon system oriented. Budget preparation and execution are similarly managed. As a result, it is now now possible to determine the effects of resource investments on the readiness and sustainability of weapon systems.

In recent years, the DoD and Congress have begun to press for use of management techniques that will allow estimates to be made of how changes in amount and allocation of resources would affect weapon system readiness. Data sources are not organized for ready access nor are management models adequate for this purpose.

OBJECTIVES: To develop methodology for determining how materiel readiness/sustainability could be expected to change as dollars invested in various resources (float end items, repair parts, test equipment, maintenance personnel, etc.) are changed.

CURRENT STATUS:
Work was suspended after a preliminary analysis was done, as a result of a AMC decision to manage this effort within the framework of a Weapon System Functional Coordinating Group (FCG). The FCG was established in October 1983 and a meeting was held at IRO to define the group's charter. It was decided to build upon ongoing work in war reserves and Combat PLL/ASL for the long term approach to weapon system management, and to use the IRO weapon system Supply Performance Analyzer to make wholesale level decisions in the short term. We will continue to keep in touch with the efforts of the Air Force and Navy through the DoD Supply Management Policy Group.

In the last year we have assisted AMC and DCSLOG with preparation of the Army Plan of Action for implementing sparing to availability. We expect this sort of consulting work to continue indefinitely until sparing to availability is implemented.

RELATED STUDIES:

1. "Operational Readiness Oriented Logistics Support Models," IRO Project No. 260, (ongoing).

2. "Supply/Maintenance Trade-Off Analysis," IRO Project No. 287 (ongoing).

US ARMY INVENTORY RESEARCH OFFICE
ONGOING STUDY SUMMARY

TITLE: NICP & Depot Criteria for Scheduling Physical Inventories

IDENTIFICATION NUMBER:
IRO Project No. 299

SPONSOR: AMC Directorate for Supply, Maintenance & Transportation
AMCSM-PSI

PROJECT OFFICER:
Donald Orr

INITIATION/PROGRAMMED COMPLETION DATES:
September 1984/April 1985

PROBLEM: There is a cost associated with making a physical inventory (PI); this cost includes overhead, ADP, and the man years necessary to schedule, count, research causes, and adjust records. In addition if there are finite resources available to conduct PI's, constraints must be imposed on the number of PI's conducted in a given period.

These costs and constraints impact scheduling policies for PI's. However, given that PI's reduce or eliminate errors between actual counts and recorded values so that better management of assets (when to buy, can order be filled) is attained, there exist trade-offs and opportunities for cost effective decision making.

There are several areas for investigation that would impact the need for timing of PI's.

(1) The efficiency of PI's and associated processes. Especially can the PI be conducted concurrently with other depot functions (surveys, receiving, issuing) and share resources?

(2) The growth of record errors between successive PI's.

(3) The effectiveness of PI's. Develop a scheduling model so as to delay the capture of error until after it has grown (due to pilferage, relocation, transaction activity), but before important decisions (buying or issuing).

(4) The alternatives to full PI's in order to reduce workload and meet resource constraints.

OBJECTIVES: These issues would be incorporated into the following phased objectives:

(a) Phase I - Investigate at department level the procedures and criteria for scheduling PI's. Can resources be shared? If and how can PI and location survey schedules and functions

be intermingled?

(b) Phase II - Develop procedure/model for NICP decision making on PI scheduling. Constraints, special policies, available resources will be considered in conjunction with item's state/characteristics (assets, activity, procurement lead time). Procedure will be synergized with any new depot level decision criteria that might arise from Phase I.

(c) Phase III - Implement and monitor for one year the Combined Depot/NICP PI scheduling criteria model.

CURRENT STATUS:

Phase I is underway. Survey of inventory accounting functions at the area oriented Depots is being conducted.

RELATED STUDIES:

1. IRO Report "Physical Inventory Decision Model," June 1972.

2. IRO Report "A Model for Scheduling Physical Inventories," April 1973.

3. IRO Report "Test of IRO Physical Inventory Decision Model," March 1974.

4. IRO Report "Conduct of Physical Inventories and Location Surveys," July 1974.

5. DLA Report "Inventory Frequency Analysis," Baker & Ken, August 1983.

US ARMY INVENTORY RESEARCH OFFICE
LOGISTICS MANAGEMENT ASSISTANCE

In addition to its formal work program, the IRO provides assistance upon request to AMC Headquarters and its Commands, and to other DA and DoD activities. The assistance involves work of a short term nature, generally requiring no more than a few man-months of effort. Some of the tasks worked on in FY1984 are described below.

CCSS Functional Coordinating Groups. The IRO continues to provide representation on the FCG's for Supply Management, Weapon System Management, Maintenance Management, Provisioning, and War Reserves. This involves attendance at meetings where System Change Requests are evaluated and doing short term studies on problems of interest to the Groups. Special tasks last year were continued assistance to the AMC Commands on use of the Weapon System SPA; an analysis of the data elements in the Materiel Management Decision File; and assistance in developing a procedure for determining procurement reorder quantities that considers quantity discounts.

Assistance to AMC Headquarters and its MSC's. A data base was identified and procedures for statistical analysis of AMC installation overage/overmileage administrative vehicles were developed. The AMSAA RAM Division assumed responsibility for the analysis as part of a larger effort.

Mr. Kaplan participated as part of an AMSAA team in a review of Firefinder support. As a result, a program to do supportability analysis, including the ability to answer what-if questions was developed for an IBM PC. MICOM subsequently reviewed this program and is using it as a basis for one they are writing.

Mr. Gajdalo participated in a concept study for AMC to automate mobilization planning. Recommendations were accepted by AMC for implementation. The prime recommendations were to incorporate a decision model within the War Reserve Automated Process (WRAP) for execution; modify WRAP to produce the POM requirements; incorporate the SES4WAR model within WRAP; and change the WRAP cycle to coincide with the POM cycle.

A short term analysis was conducted by Dr. Orr to develop guidance for adjusting OMA requirements in the PAAR report when changes are postulated for end item density and usage. An extensive MFR was written for the sponsor (AMC PA&E) and sent to him as a read-ahead prior to a formal briefing on findings.

Mr. Kotkin assisted AVSCOM with a review of sustainability models developed by the Concept Analysis Agency. These are called Overview and PARCOM. It was pointed out to AVSCOM that the models, because of restrictive assumptions, severely underestimate true parts requirements.

Assistance to Department of Defense

Mr. Gajdalo worked with the Office of the Secretary of Defense to improve DoD Instruction 4140.47, Secondary Item War Reserve Requirements Development. The efforts resulted in the publication of the official instruction (DoDI 4140.47) on 24 February 1984. Through the Office of the Secretary of Defense,

Mr. Gajdalo has fielded numerous questions related to the policies and procedures in the instruction.

Mr. Kaplan consulted with the Office of the Secretary of Defense on service responses to draft DoDI 4140.42. (IRO had chaired tri-service group which developed changes to current version.)

Other Consulting Assistance

Procedures for computing retail retention levels were developed for DA DCSLOG by Mr. Kaplan. These procedures are tentatively scheduled for implementation in SARSS.

As part of a working group, Dr. Orr helped structure the Cost and Operational Effectiveness Analysis (COEA) for the Intermediate Forward Test Equipment (IFTE) concept. He also made the many SESAME runs required to assess stockage costs of various maintenance alternatives for the weapon systems included in the IFTE COEA.

Mr. Kaplan consulted with US Department of Labor on a statistical analysis of targeting procedures used to monitor compliance of labor organizations with the Landrun-Griffin Act.

US ARMY INVENTORY RESEARCH OFFICE
PROFESSIONAL ACTIVITIES

Paper by Alan Kaplan and Donald Orr, "An Optimum Multi-Echelon Repair Policy and Stockage Model" was accepted for publication in the Naval Research Logistics Quarterly.

A proposed solution to a production/inventory forecasting problem by Edwin Gotwals appeared as part of "The Forecasting Workshop in Print" in the Summer 1984 issue of the Journal of Business Forecasting Methods and Systems.

Don Orr presented a paper, "Optimal Allocation of Multi-purpose Test Equipment Across Weapon Systems" at the ORSA/TIMS Symposium in Orlando, FL, November 1983.

Meyer Kotkin chaired a session on Evaluation Techniques at the joint ORSA/MAS and MORS meeting on Relating Resources to Readiness and Sustainability.

Alan Kaplan gave a paper entitled "Dynamic Inventory Control with Learning" at the Spring combined national meeting of TIMS/ORSA.

Alan Kaplan and Meyer Kotkin served as referees for Management Science; Meyer Kotkin refereed a paper for NRLQ.

Robert Deemer gave a paper "Forecasting Performance for Slow Moving Items" to the Army Research Office Workshop on Analytical and Computational Issues in Research and Development held at George Washington University, 7-9 May 1984. The workshop focused on issues in logistics.

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US ARMY INVENTORY RESEARCH OFFICE
PUBLISHED REPORTS

"Sortie Duration and Helicopter Component Failures (An Empirical Study)," Edwin Gotwals, May 1983, (ADA134745).

"Test of Poisson Failure Assumption," Sally Frazza, September 1982, (Interim Note), (ADA137285).

"The OATMEAL Model - Optimum Allocation of Test Equipment/Manpower Evaluated Against Logistics," Alan Kaplan and Donald Orr, February 1983. (ADA136690).

"Annual Report FY1983," January 1984, (ADA137247).

"Major Assemblies Stockage Model," Arthur Hutchison, January 1984, (ADA139854).

"Over-Ocean Cargo Forecasting," Robert Deemer and Edwin Gotwals, December 1983, (ADB083456).

"An Organized Procedure for Evaluating Provisioning Decisions Using SESAME: A Case Study Using The Abrams Tank," Donald Orr, February 1984, (ADB088847).

"The Bayesian Inventory Problem," Alan Kaplan, May 1984, (ADA150812).

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